Unnamed Tributary to Hurricane Branch *IR CATEGORY:* **4A**

WATERBODY SIZE: **1.03 Miles**

From Blackstone STP discharge to mouth at Hurricane Branch.

ASSOCIATED ADB ASSESSMENT UNITS:

VAC-K16R_XBL01A94		

IMPAIRED AREA ID: **VAC-K16R-01** *TMDL PROJECT ID:* **00005**

This segment does not support the **Aquatic Life** use. This segment is impaired for **Benthics**

SOURCES: **Unspecified Urban Stormwater**

TMDL DUE DATE: **2004** *1999 CONSENT DECREE?:* **Y**

Station IDs:
5AXBL001.18 (Benthic) Not Impaired, Upstream of Blackstone WWTP
5AXBL000.80 (Benthic) Moderately Impaired, Downstream of Blackstone WWTP
UT, Hurricane Branch TMDL - EPA Approved 9/30/04

Benthic TMDL for Hurricane Branch Unnamed Tributary, Virginia

Submitted by

Virginia Department of Environmental Quality

Prepared by

George Mason University

and

THE Louis Berger Group, INC.
2300 N Street, NW
Washington, DC 20037

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TMDL Allocation

Sediment TMDL allocations for Hurricane Branch (UT) were based on the following equation.

$$TMDL = WLA + LA + MOS$$

Where:

TMDL= Sediment Load of the Adjusted Reference Watershed

WLA = Wasteload Allocation

LA = Load Allocation

MOS = Margin of Safety

The wasteload allocation represents the total sediment loading allocated to point sources. The load allocation represents the total sediment loading allocated to non-point sources. A margin of safety is applied to account for uncertainty in methodologies and determination of sediment loadings. An explicit margin of safety of 10% was used for Hurricane Branch (UT).

The total wasteload allocated to the Blackstone STP was based on the permitted discharge loading rate for total suspended solids. Load allocations for non-point sources were based on an equal percent reduction from controllable sources. Loads from forested lands are considered to be representative of the natural condition and therefore were not subject to reductions. By reducing sediment loads from agricultural and developed lands and instream erosion by 67%, the sediment TMDL endpoint is achieved. The TMDL for Hurricane Branch (UT) is shown in Table E-1 and the recommended TMDL allocations and the percent reduction required for all watershed sources are presented in Table E-2.

Table E-1: Sediment TMDL for Hurricane Branch (UT) (tons/year)

TMDL	Load Allocation	Wasteload Allocation	Margin of Safety (10%)
144.5	69.1	60.9	14.5

2.1.6 Ecoregion Classification

Hurricane Branch (UT) is located within the Piedmont ecoregion, Level III classification number 45 (Woods et al., 1999). This ecoregion extends from Wayne County Pennsylvania southwest through Virginia, and comprises a transitional area between the mostly mountainous ecoregions of the Appalachians to the northwest and the flat coastal plain to the southeast. Once largely cultivated, much of this region has reverted to pine and hardwood woodlands. The Piedmont ecoregion is characterized by shallow valleys, irregular plains, and low rounded hills and ridges. The underlying geology of this region consists of deeply weathered, deformed metamorphic rocks with intrusions by igneous material. The location of the Hurricane Branch (UT) watershed within the Piedmont ecoregion is displayed in Figure 2-3.

2.2 *Permitted Discharge Facilities*

There are two permitted facilities in the watershed that discharge into Hurricane Branch (UT); these are the Town of Blackstone Sewage Treatment Plant (STP) and Water Treatment Plant (WTP). Facility permit numbers, design flows, and status are presented in Table 2-5. A map of the permitted facilities is presented in Figure 2-4. The Blackstone WTP recently began routing its discharge to the Blackstone STP and no longer discharges to the Hurricane Branch (UT) except for emergencies. The Blackstone STP was upgraded in 2000 in order to meet a compliance schedule for permitted discharge of ammonia.

Table 2-5: Permitted Discharge Facilities in the Hurricane Branch (UT) Watershed

Permit Number	Facility Name	Design Flow (gpd)[a]	Status
VA0025194	Blackstone STP	2,000,000	Active
VA0005827	Blackstone WTP	Not Applicable[b]	Active

a: Gallons per day
b: Effluent from the Blackstone WTP is currently routed to the Blackstone STP for treatment

Sediment loadings from generalized land use types present in the Hurricane Branch (UT) watershed are discussed below.

Forested Lands

Sediment loads from forested lands are typically low due to extensive root systems and vegetative cover that serve to stabilize soils. In addition, forest canopies intercept and dampen rainfall impacts.

Agricultural lands

Sediment loads from agricultural lands tend to be elevated due to the exposure of soil that occurs in agricultural practices. Cropland and pastureland are two sources of elevated sediment loads.

Developed Lands

Developed lands consist of both pervious and impervious surfaces. Impervious surfaces are not subject to soil erosion, but sediment loads may result from the washoff of solids deposited on impervious surfaces. Sediment loads from developed lands tend to be high. In addition, elevated levels of uncontrolled stormwater runoff from developed lands contribute to streambank erosion as discussed below.

Water/Wetlands

The amount of sediment loading from water and wetland areas typically is not significant.

6.1.2 Point Sources

Sediment loadings from point sources are attributable to the suspended solids present in discharge effluent. The Blackstone STP discharges solids to Hurricane Branch (UT). As stated previously, the Blackstone WTP recently began routing its effluent to the STP for treatment, and does not currently directly discharge effluent into Hurricane Branch (UT).

6.1.3 Instream Bank Erosion

Sediment derived from instream bank erosion is also dependent upon numerous watershed characteristics. Land use types present in the watershed may affect hydrology of the watershed. In particular, highly developed lands may lead to increased stream flows that erode the stream channel and banks. Likewise, watersheds defined by steep topography may experience high levels of runoff that cause instream erosion. The level of instream erosion is dependent on the erodibility of the soil, normally defined as the soil K factor.

6.2 Technical Approach for Estimating Sediment Loads

6.2.1 Non-point Source Load

For the purpose of TMDL development, annual sediment loadings from land erosion were determined using the Generalized Watershed Loading Functions (GWLF) model.

6.2.1.1 GWLF Model Description

GWLF is a time variable simulation model that simulates hydrology and sediment loadings on a watershed basis. Observed daily precipitation data is required in GWLF as the basis for water budget calculations. Surface runoff, evapotranspiration and groundwater flows are calculated based on user specified parameters. Stream flow is the sum of surface runoff and groundwater discharge. Surface runoff is computed using the Soil Conservation Service Curve Number Equation. Curve numbers are a function of soils and land use type. Evapotranspiration is computed based on the method described by Hamon (1961) and is dependent upon temperature, daylight hours, saturated water vapor pressure, and a cover coefficient. Groundwater discharge to the stream is described by a lumped parameter watershed water balance for unsaturated and shallow saturated water zones. Infiltration to the unsaturated zone occurs when precipitation exceeds surface runoff and evapotranspiration. Percolation to the shallow saturated zone occurs when the unsaturated zone capacity is exceeded. The shallow saturated zone is modeled as a linear reservoir to calculate groundwater discharge. In addition, the model allows for seepage to a deep saturated zone.

Erosion and sediment loading is a function of the land source areas present in the watershed. Multiple source areas may be defined based on land use type, the underlying soils type, and the management practices applied to the lands. The Universal Soil Loss Equation (USLE) is used to compute erosion for each source area and a sediment delivery ratio is applied to determine the sediment loadings to the stream. Sediment loadings from each source area are summed to obtain a watershed total.

6.2.2 Point Source Load

Two point source facilities are present in the Hurricane Branch (UT) watershed as shown in Table 6-1. No point sources are present in the reference watershed. For the purpose of

TMDL development, annual point source loadings were computed based on the permitted discharge loading rate for total suspended solids.

Table 6-1: Point Sources in Hurricane Branch (UT) Watershed

Facility Name	Permit No.	Permitted Total Suspended Solids (kg/day)	Annual Sediment Loading (tons/year)
Blackstone STP	VA0025194	151.4	60.9
Blackstone WTP	VA0005827	NA*	NA*
*The Blackstone WTP now routes its discharge to the Blackstone STP.			

6.2.3 Instream Erosion

Instream erosion for the Hurricane Branch (UT) impaired watershed and the Twittys Creek reference watershed was calculated using a spatial technique developed by Evans et al. (2003) that estimates streambank erosion based on watershed characteristics. Using this method, a watershed-specific lateral erosion rate is calculated as follows:

$$LER = aQ^{0.6}$$

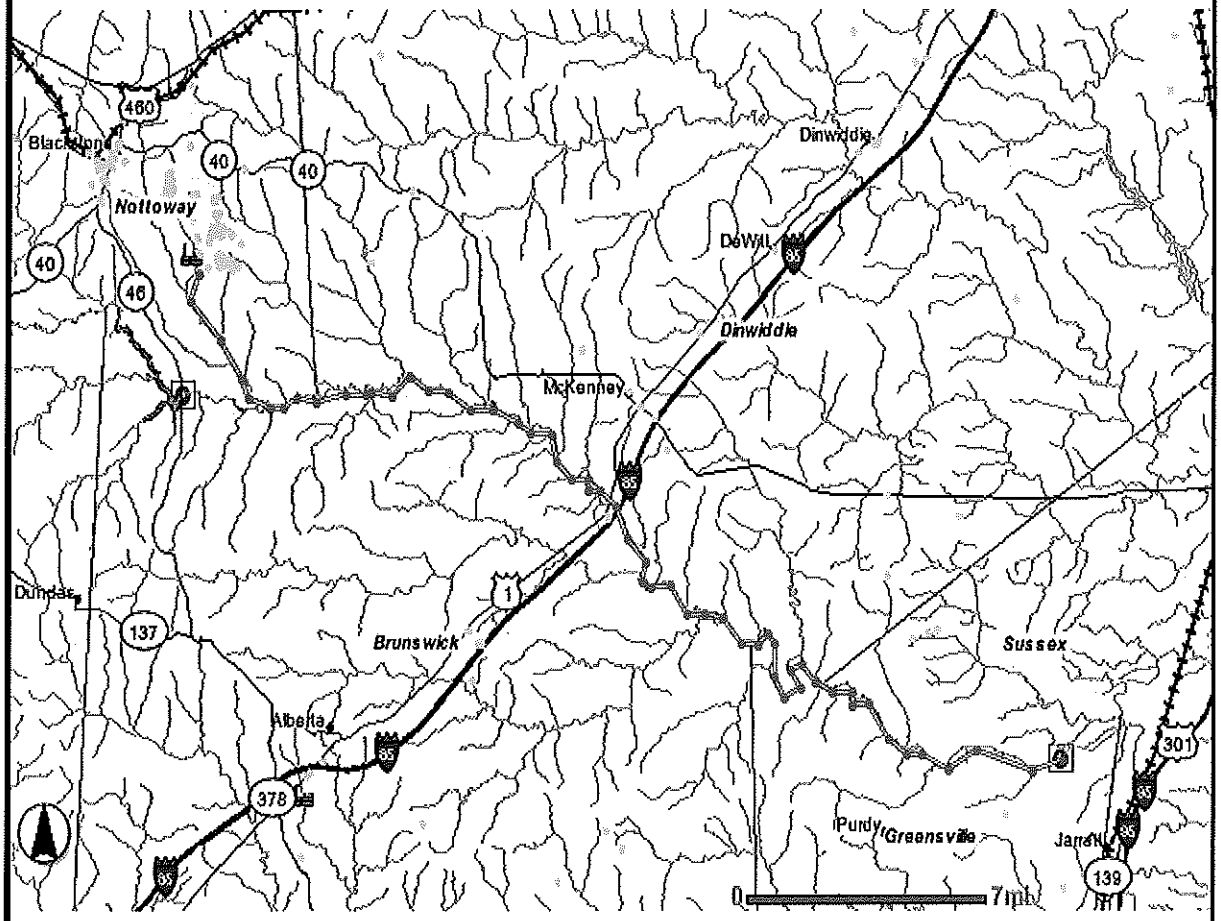
Where:
LER = an estimated lateral erosion rate, expressed as meters per month
a = an empirically-derived "erosion potential factor"
Q = monthly stream flow, expressed as cubic meters per second.

The 'a' factor is computed based on a wide variety of watershed parameters including the fraction of developed area of the watershed, average field slope, mean soil erodibility (K factor), average curve number value, and the mean livestock density for the watershed.

$$a = (0.00147*PD) + (0.000143*AD) - (0.000001*CN) + (0.000425*KF) + (0.000001*MS) - 0.000016$$

Where:
PD = fraction developed land
AD = animal density measured in animal equivalent units/acre
CN = area-weighted runoff curve number value
KF = area-weighted K factor
MS = mean field slope

ArcIMS HTML Viewer Map



DEQ
VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY

Legend

Legend

Petroleum Releases

Major VPDES Permits

- Industrial
- Municipal

All Cities

Interstates

US Highways

Primary Highways

Rail Lines

Detailed Rivers (NHD)

Lakes and Chesapeake Bay

Solid Waste Facilities

- Construction Demolition Debris Landfill
- Material Recovery Facility
- Sanitary Landfill
- Transfer Station

VDH SW Withdraw Points

Regional Boundaries

- Northern
- Piedmont
- South West
- Tidewater
- Valley
- West Central
- South Central

Counties

Distance ≈ 36 miles

1. GCWSA - Jarratt Withdraw
2. Town of Jarratt Withdraw